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SCIENCE.

FRIDAY, MAY 28, 1886.

COMMENT AND CRITICISM.

THE ELECTION OF A PRESIDENT of a college or university, especially in the case of one so venerable and distinguished as Yale, is an event of great importance. Under the present constitution of our colleges, — and it is by no means so faulty as some persons declare it to be, — the presidents not only govern, but they represent their institutions. The president's voice is generally the controlling influence in matters of academic policy and discipline, in financial matters, and in the selection of professors and subordinate officers: therefore his importance and sphere of activity are not limited to his own college, but are co-extensive with the wide boundaries of higher education. This fact has entered, though perhaps unconsciously, into the popular interest which has been manifested as to the choice of the Yale corporation for the succession to President Porter. Undoubtedly the activity of the younger alumni of Yale has served to keep the matter prominently before the public, but we know that in the university world, at all events, considerations higher than merely personal ones have been taken into account.

On Thursday of last week the matter was settled by the election of Rev. Timothy Dwight, professor of sacred literature in the Yale theological school, to the presidency of Yale college. Professor Dwight's election cannot be called unexpected, for the well-informed had some months ago settled upon him as the coming man. But there are elements in the choice which make it a peculiarly happy one. In the first place, no college, however progressive, can afford to break entirely with its past, to which, after all, it owes its present. The fact that Professor Dwight graduated from Yale in 1849, and has for more than thirty years been connected with the college as tutor and professor, identifies him sufficiently with the traditional policy of Yale to insure that it will not be inconsiderately abandoned. Then there are elements in the newly chosen president's personal views and opinions which promise that

Yale will not be left behind in the race of development. He has carefully considered the details of university policy and organization, and we may be sure that he will guide Yale on the forward path as rapidly as the college can travel — but no more rapidly. That is the great point: Yale must grow and develop, but she must not lose her character in the process. Educated men throughout the country look to President Dwight to secure this happy mean.

IMITATION BUTTER.

THE manufacture of substitutes for butter originated with the production of the so-called oleomargarine, by the French chemist Mége-Mouriez, from beef-tallow. During the siege of Paris by the Germans, the making of this artificial butter was carried on upon a considerable scale, and was first brought prominently into notice. The manufacture of oleomargarine commercially, however, did not cease with the necessity which gave birth to it, but with various modifications has increased in amount, until now it is believed to have seriously damaged the dairy interests of the country; and congress is being urged to pass a bill, which, under the guise of a revenue law, is really a prohibition law. The agitation has attracted such general attention, both from dairy-men and from consumers of butter, and so much misrepresentation and flaming rhetoric have been called forth, that it may be worth while to consider calmly what are the facts in the case.

Process of manufacture. — Although numerous patents have been taken out for the manufacture of imitation butter, and a great variety of materials have been named in the specifications, the process as now conducted is comparatively simple. The raw materials are beef-tallow, leaf-lard, and the best quality of butter, together with small amounts of milk or cream and of butter-color.

From the beef-tallow is prepared the oleomargarine oil of Mége. The caul fat of freshly killed beeves is, after thorough washing, first in tepid and then in iced water, allowed to hang in a cold room until thoroughly cold. It is then rendered at a temperature between 130° and 175° F. The resulting oil is allowed to cool slowly until a considerable portion of the stearine and palmitine have crystallized out, and the pasty mass is then subjected to hydraulic pressure. The still fluid portion (about two-thirds of the whole) flows

out into a tank of cold water, where it solidifies into a granular mass which is known in the trade as 'oleo-oil,' or simply 'oleo.' The name 'oil' is somewhat misleading, as the product is a granular solid of a slightly yellow color. Fresh leaf-lard, treated in substantially the same way as the beef-tallow, yields the 'neutral lard,' or 'neutral,' of the trade, also a granular solid of a white color.

The objects of this treatment are twofold,—first, to produce fats as free as possible from taste or odor; second, to remove some of the difficultly fusible stearine and palmitine in order that the finished product may melt readily in the mouth.

Having thus secured the fats in proper condition, the manufacturer proceeds to mix the 'oleo' and 'neutral,'—the proportions varying according to the destination of the product; a warm climate calling for more 'oleo,' a cold one for more 'neutral,'—and to flavor the mixture with butter. This flavoring is conducted in large, steam-jacketed vessels provided with revolving paddles, by which their contents can be thoroughly agitated. Here the 'oleo' and 'neutral' are melted, and thoroughly agitated with a certain proportion of milk, or sometimes of cream, and a proper amount of butter-color. Forty-eight gallons of milk per two thousand pounds of product are stated to be a common proportion. After sufficient agitation, the melted mass is run into cold water, and as it cools is broken up by paddles so as to granulate the mass. After thorough washing, it is salted and worked exactly like butter. The product is known as oleomargarine. Although it contains hardly more than a trace of butter-fat, the latter flavors the whole mass so strongly that when well salted, as it usually is, it might readily pass with an inexpert or careless consumer for a rather flavorless butter. Oleomargarine is the cheapest product made. By adding to the material in the agitator, or 'churn,' more or less pure butter, what is known as butterine is produced, two grades of which are commonly sold; viz., 'creamery butterine,' containing more, and 'dairy butterine,' containing less butter.

Healthfulness.—Very exaggerated and absurd statements have been made, especially by the dairymen and their organs, regarding the unhealthfulness of butterine and oleomargarine. The charges have in general been, that the fat used is practically uncooked, and that raw animal fat is unwholesome; that filthy fat, and fat from diseased animals, are used, and that the product contains, or is liable to contain, the germs of disease; and that, in cleansing these diseased and filthy fats, dangerous chemicals are used, which are not subsequently completely removed.

That the fats used are of themselves unwholesome, there is no proof whatever. They contain nothing that butter-fat does not also contain, and differ from it only by the absence of about six per cent of the glycerides of certain soluble fatty acids; viz., caprinic, caprylic, capronic, and butyric acids. The only experiments upon the digestibility of imitation butter are two, by A. A. Mayer, upon oleomargarine. These showed a difference of only about two per cent in favor of butter. That the higher flavor of butter acting upon the nervous system would give it a greater nutritive value than the flavorless 'neutral' or 'oleo,' may be conceded; but that an article which even experts fail to distinguish from genuine butter is at any serious disadvantage in this respect, may well be doubted.

The manufacturers claim that imitation butter can only be made from the best quality of fat from freshly killed animals, and I know of no evidence which disproves their assertions. The sensational article recently published in a prominent agricultural paper in the north-west, accompanied by cuts of the numerous organisms found in butterine, is of no significance in this connection, both because the species described are all harmless, and because no comparative examinations of genuine butter were made. It is highly probable that many samples of the latter would show as miscellaneous an assortment of formidable-looking, harmless organisms as did the butterine.

On the other hand, however, there is at present no guaranty, except the statement of the manufacturers, that diseased fat is not or can not be used; the manufacture being conducted entirely without any official inspection, and visitors being in most (not all) cases excluded. I believe that the chances of disease being conveyed in this way are small, but they are not yet proved to be non-existent.

As regards filthy processes of manufacture, it may safely be asserted that butterine could not successfully imitate butter were it not as clean as most things are which pass for clean in this dirty world.

The charge that dangerous chemicals are used in the manufacture may be disposed of in a few words. If a dangerous amount of any chemical which is claimed to be used were left in the finished product, the latter would be inedible. Should traces of these chemicals be found, their significance would not lie in themselves, but in the indication they would furnish that the original fats were impure and required chemical treatment.

Fraudulent sale.—The evil feature of the trade in imitation butter is that it is largely fraudulent.

A prominent manufacturer of butterine lately told the writer, in response to an inquiry, that, in his opinion, not over twenty-five per cent of the butterine made in the United States is sold under its true name. It may safely be assumed that the estimate is not too low, and that fully three-quarters of the product is eventually sold and eaten as butter. Reliable statistics of the production of imitation butter are not to be obtained, so far as I have been able to find, but it must be enormous. The fact, which is stated on good authority, that Chicago, one of the chief seats of the manufacture, exports more 'butter' than it imports, is suggestive in this connection. The manufacturer, it may be assumed, sells his product as an imitation, though even here facilities for deception are afforded in the use of such names as 'creamery' and 'dairy' butterine, and in the branding of packages with the names of imaginary creameries. But as the imitation passes through the hands of jobber, retailer, and restaurant or boarding-house keeper, to the consumer, it undergoes a transformation, until, at the end, it is the exception when it is not butter simply, with no suffix. Since the imitation can be produced much cheaper than the genuine article, and can with difficulty be distinguished from it, it affords a tempting opportunity to the middleman to increase his profits. As a natural result, the manufacture of and trade in genuine butter have suffered under this unfair competition, and a wide-spread change in the butter trade of the cities is taking place. Consumers, wisely or unwisely, are generally very averse to eating butterine at all, as well as to paying the price of butter for it, and in self-defence are coming more and more to make contracts for butter directly with reliable producers, to the benefit of both parties and the injury of the middlemen, who seem now to be in a fair way to reap as they have sown.

Legislation. — The undoubted injury to the dairy business wrought by the manufacture and fraudulent sale of butterine and oleomargarine has been the incentive to an earnest search for a remedy; and the aid of legislation was speedily invoked, first in the shape of laws to compel the branding of every package of these articles, and, later, of laws prohibiting entirely their manufacture and sale. Neither class of laws proving effective, and the New York law having been pronounced unconstitutional by the court of appeals, the aid of national legislation is now being invoked.

Several bills upon this subject have been introduced into the present congress; but the one which has become most prominent, and has apparently met with the most favor from the oppo-

nents of butterine, is the substitute bill reported by the committee on agriculture, by which it is intended to indirectly prohibit the manufacture of imitation butter. There are numerous minor provisions; but the main ones, which render all others superfluous, are the imposition of a license-fee of six hundred dollars upon every manufacturer, four hundred and eighty dollars upon every wholesaler, and forty-eight dollars upon every retailer, and of an internal revenue tax of ten cents per pound upon all imitations of butter manufactured or imported, the tax upon the latter being in addition to the customs duty. The internal revenue department is charged with the execution of the law. In short, it is proposed to tax the business out of existence.

The writer does not hesitate to express his belief that the enactment of this law is not desirable. As is evident from the description already given of the process of manufacture, and as the writer is convinced by personal inspection, imitation butter, when properly made, or when made as the manufacturers claim that it is, is a perfectly cleanly, wholesome article of food. Granting this, the prohibition of its manufacture is simply class legislation, designed to advantage the producer of butter by increasing the price of his product, to the detriment of the consumer. The dairy interest of the country is undoubtedly of great magnitude, and may well be fostered in all legitimate ways; but no interest has the right to be 'protected' at the expense of the whole people.

Another objection to a heavy tax on this article, unless it be absolutely and hopelessly prohibitory, is that it will tend to stimulate exactly what appears to be now the greatest danger connected with the manufacture of butter-substitutes. In addition to the pressure of competition, we should have the pressure of taxation forcing the manufacturer to seek cheaper and cheaper sources for his raw materials, and tempting him to use unhealthy fats, if he can do so without detection.

Further, the writer ventures to doubt whether the permanent injury which this manufacture will work to the dairy interest will be so great, or the advantage of its suppression so marked, as is commonly supposed, provided that the imitations are compelled to be sold for what they are. Butterine, undoubtedly, has depressed the price of butter, partly by displacing it, and partly by creating a general distrust of the genuineness and wholesomeness of what is offered to the consumer as butter. It is worth considering, however, to what extent this would be offset, in time, by the increased consumption of butter, both *per se* and in butterine, which will presumably follow from its lower price.

But while the writer does not advocate legislative prohibition, he does most strongly believe in the necessity for legislative regulation. The objects to be attained by such regulation are, first, to insure that only clean and wholesome materials are used in the manufacture, and that the process is conducted in a careful and cleanly manner; and, second, to compel the sale of the product under its own name and on its own merits. When this is done, all is done that the state can properly do.

Space forbids entering into any discussion of the best methods of reaching these objects. Some system of registration and inspection of factories would evidently be necessary to accomplish the first; while the second might be attained by compulsory branding of packages, use of a peculiar style of package, requiring manufacturer and jobber to keep a record of all packages sold, with name of buyer, and numerous other devices. Probably both these objects would be most readily accomplished by putting the whole matter in the hands of the Internal revenue bureau, while it might fairly be taxed sufficiently to cover the cost of inspection, etc.

Finally, it is to be remembered that butterine is but one of many forms of food-adulteration. The most satisfactory treatment of the subject would be the enactment of general laws, state or national, upon the subject of food-adulteration, and the provision of an efficient power to enforce them.

Methods of detection. — There is no simple test by which the consumer may determine for himself whether a sample of butter is genuine: the adulteration can be detected only by the expert chemist or microscopist. Butter, as already noted, differs from all other animal and most vegetable fats, in containing about six per cent of the glycerides of certain soluble fatty acids. It is upon this fact that all chemical methods for the detection of butter-adulteration are based. The original method, as proposed by Hehner, consisted in determining the percentage of insoluble fatty acids. In butter this averages about 87.5 per cent, while in other animal fats it averages about 95 per cent. Koettsdorfer determines the weight of pure potash required to saponify one gram of the fat. Owing to the lower molecular weight of the peculiar acids of butter, more potash is required to saponify this fat; the range being 221 to 232 milligrams of potash for butter, and 195 to 197 for other fats. Reichert, after saponifying the fat and setting free the fatty acids again by addition of sulphuric acid, all the operations being conducted in a uniform manner, distils over a fixed volume of the resulting liquid, and determines the amount of potash required to neutralize it. The distillate

from 1 gram of butter-fat requires 13.0 to 14.9 cubic centimetres of a deci-normal potash solution; that from other fat, a fraction of 1 cubic centimetre.

Of these methods, Hehner's is too tedious for ordinary use; Koettsdorfer's is very readily and quickly applied, and in general gives unequivocal testimony as to the genuineness of the sample; Reichert's requires somewhat more time and skill than Koettsdorfer's, but still is a simple method, and gives trustworthy results, and has advantages in certain cases.

The results obtained by either of these methods may evidently serve as the basis of an approximate computation of the extent of the adulteration. Owing to the somewhat variable composition of butter, however, the approximation cannot be a very close one, and slight adulterations would pass undetected. It will not often be the case, however, that butter is slightly adulterated; so that practically but little difficulty will arise from this fact, so far as the detection of the falsification is concerned. For a calculation of the extent of the adulteration, Reichert's method has proved the more satisfactory in my laboratory, Koettsdorfer's giving usually decidedly too low results.

Cornwall¹ has recently called attention to the fact that cocoanut-oil is said to be used in the manufacture of butterine. This oil, unlike most others, contains a considerable proportion of soluble fatty acids; and mixtures of this fat with oleo-oil or neutral may be made which behave exactly like butter with Hehner's or Koettsdorfer's tests. They may be distinguished, however, according to Cornwall, by Reichert's method, the soluble acids being much less volatile than those of butter; the distillate containing, consequently, but little of them.

Besides the chemical methods, the more important of which have been described, various attempts have been made to devise optical tests, but with indifferent success. Among others, Dr. Thomas Taylor, microscopist of the U. S. department of agriculture, has described a method which has received such extensive notice as to merit a few words. He proceeds substantially as follows: some butter is melted and 'boiled' for a short time (that is, the water which it contains is boiled), and then allowed to cool slowly. A small portion of the solidified butter is mounted in a little olive-oil on an object-glass, and under the microscope is seen to consist of irregular globular masses consisting of aggregations of fat-crystals. When these are examined with polarized light in the dark field, each shows a pretty well defined St. Andrew's cross. Dr. Taylor's original claim was that these globules, and particularly their ap-

¹ Report of New Jersey state board of health.

pearance by polarized light, were peculiar to butter, and could serve as a means of distinguishing it from imitations; and the commissioner of agriculture, in his last report (p. 36), states, that, at the time of writing, two convictions for violations of the butter-laws had been secured in the District of Columbia by the aid of Dr. Taylor's method.

Professor Weber, of the Ohio state university, however, has recently shown that lard and oleo-oil do not differ essentially from butter in this respect. By 'boiling' the butter as Dr. Taylor directs, some of its water is removed, and a formation of minute salt-crystals takes place. As the butter cools, these minute crystals of salt serve as nuclei for the formation of the butter-globules. Professor Weber shows that if melted lard or tallow be allowed to cool under the same conditions, they too form globules which exhibit the St. Andrew's cross.

In an open letter to Dr. E. Lewis Sturtevant, director of the New York agricultural experiment-station, Dr. Taylor attempts to break the force of Professor Weber's experiments, and also shifts his ground, claiming that the distinguishing difference between butter and other fats under the microscope is that the former, when viewed by polarized light through a selenite, shows a uniform tint, while the latter exhibits prismatic colors.

Whether this claim rests on any better foundation than the former, the writer will not undertake to say; but it is plain that further investigation would not be out of place.

H. P. ARMSBY.

ENGLAND'S COLONIES.

THE opening of the Colonial and Indian exhibition at South Kensington gave rise to an article in the London *Times*, on the growth of England's colonial possessions. The Portuguese and Spaniards, and even the French, were in the field long before England. Spain had a settlement in Dominica as early as 1493, and Vasco da Gama reached India in 1498. Within very few years India and South America had their Portuguese and Spanish viceroys. In 1534 Jacques Cartier made his famous voyage up the St. Lawrence, taking possession of the country in the name of the French sovereign. True, Cabot discovered Newfoundland and the mainland of North America in 1497; but he, like other early western navigators, simply regarded the new world as a barrier on the way to India. It was this latter land of fabulous riches that was the goal of the infant naval enterprise of England for many years after Cabot's discovery. The Portuguese monopolized

the routes by the southern seas, and England had not yet a navy to cope with its rival.

So effort after effort was made, in craft not much more formidable than cock-boats, to find a passage to India either by the north-west or north-east. Not till our own days have these passages been sailed over; but long before had they been given up as hopeless routes to China and India. Many a life did these early attempts cost England; but to them, no doubt, is greatly due the rapid progress she made as a naval power.

Up to the end of the sixteenth century, while Portugal and Spain were rapidly extending their sway in Asia and America, England had only a doubtful possession of Newfoundland along with powerful French rivals. Even Sir Humphry Gilbert's attempt to effect a settlement on the island in 1583 can hardly be regarded as other than abortive, though it gives Newfoundland a claim to be regarded as the earliest British colony. The first effective English settlement on the island cannot be dated earlier than 1623, long before which Virginia had been planted and Jamestown founded. True, in 1580 the British flag was planted in the West India island of Tobago, but that island was not effectively occupied by England till 1763.

Meanwhile, some roving Englishmen had in 1605 planted a cross in Barbadoes, inscribed 'James, king of England and of this island,' though there was no actual settlement till 1625. Barbadoes is one of the two or three British West India islands that never changed hands. After all, however, Bermuda may fairly claim to be considered the earliest of existing English colonies, as it was colonized both from Virginia and England shortly after 1609. But later, during the seventeenth century, the growth of England's colonial possessions was slow, if we except the New England states and the settlements on the east American coast to the south. Leaving these last out of view, her colonies at the close of the century were few and scattered, compared with the enormous territories which Portugal and Spain, France and Holland, were endeavoring to drain of their wealth. Even in India, during the seventeenth century, she can hardly be said to have got beyond the factory stage. The East India company were simply lease-holders of the native princes. Newfoundland, as already indicated, was only permanently settled in 1623, fourteen years after the planting of Bermuda. In the same year an English colony was planted in Nova Scotia, which then included New Brunswick, though it was only at the peace of Utrecht (1713) that England can be said to have obtained undisputed possession.